


Performance measurement at STC

Measurements were performed at standard test conditions (STC) with a flash light solar simulator class AAA acc. to IEC 60904-9:2007. In order to correct the spectral mismatch error between the primary calibrated reference cell and the test samples a spectral mismatch factor was computed and applied to each IV curve measurement.

At the express request of the customer the electrical module stability has not been investigated.

Test date [DD/MM/YYYY]		02/12/2014				
Irradiance [W/m²]		Corrected to 1000 acc. to IEC 60891 (measured with crystalline reference cell)				
Module temperature [°C]		Corrected to 25				
Used curve correction parameter:						
Spectral Mismatch Factor		Top layer:	0.9820	Bottom layer:	0.8912	
α [%/K]		0.09				
β [%/K]		-0.22				
R _s [mΩ]		1000				
a		0.06				
Sample #	P _{max} [W]	V _{mpp} [V]	I _{mpp} [A]	V _{oc} [V]	I _{sc} [A]	FF [%]
HV2014004239	37.4	35.84	1.04	54.87	1.39	48.9
HV2014004240	40.1	37.61	1.07	55.63	1.40	51.3
HV2014004241	29.4	33.83	0.87	53.85	1.23	44.3
HV2014004242	30.5	35.30	0.86	54.74	1.23	45.3
HV2014004243	26.6	31.30	0.85	53.56	1.22	40.7
HV2014004244	31.0	34.31	0.90	53.25	1.24	46.7
HV2014004245	31.8	36.44	0.87	56.17	1.20	47.1
HV2014004246	30.6	34.00	0.90	53.59	1.24	45.9
HV2014004247	31.7	34.25	0.93	53.34	1.26	47.1
HV2014004248	26.9	32.36	0.83	54.00	1.21	41.2
HV2014004249	30.2	33.78	0.89	54.05	1.23	45.4
HV2014004250	26.7	31.36	0.85	54.12	1.21	40.9
HV2014004251	38.4	34.71	1.11	53.41	1.46	49.1
HV2014004252	37.4	36.64	1.02	55.02	1.37	49.4
HV2014004253	37.5	35.93	1.04	54.95	1.40	48.9
HV2014004254	32.2	34.33	0.94	53.91	1.30	45.9
HV2014004255	32.3	34.46	0.94	54.51	1.28	46.3
HV2014004256	30.8	33.80	0.91	53.06	1.29	44.9
HV2014004257 *	-	-	-	-	-	-
HV2014004258	33.3	34.89	0.95	54.27	1.31	47.0
HV2014004259	31.2	34.30	0.91	54.14	1.28	45.0
HV2014004260	30.4	32.68	0.93	53.30	1.30	43.7



HV2014004261	28.5	32.51	0.88	54.77	1.26	41.3
HV2014004262	41.9	37.72	1.11	55.57	1.47	51.3
HV2014004263	42.1	37.86	1.11	55.59	1.47	51.4
HV2014004264	40.1	37.04	1.08	55.84	1.44	49.8
HV2014004265	41.7	37.94	1.10	55.69	1.46	51.3
HV2014004266	38.9	36.59	1.06	56.09	1.42	48.7

Supplementary information:

* IV curve measurement not possible due to an internal and not visual defect. Measurement of V_{oc} not possible as well.

The measuring uncertainty of P_{max} is $\leq \pm 6.1 \%$

The measuring uncertainty of I_{sc} is $\leq \pm 6.1 \%$

The measuring uncertainty of V_{oc} is $\leq \pm 0.6 \%$

Power values compared with the type label information

The following tables compares the measured and spectral mismatch corrected power values (P_{max}) from the previous section to the nominal and minimum power ratings from the module type label (tolerance limits $\pm 5\%$).

Sample #	Serial number	P_{max} [W]	P_{Label_Min} [W]	$(P_{max}) - (P_{Label_Min})$ [W]	Dev. P_{max}/P_{Label_Min} [%]
HV2014004239 ¹	09E1115-253E	37.4	47.5	-10.1	-21.3
HV2014004240 ¹	08E1115-308E	40.1	47.5	-7.4	-15.6
HV2014004241 ¹	09E0826-269E	29.4	47.5	-18.1	-38.1
HV2014004242 ¹	09E0826-432E	30.5	47.5	-17.0	-35.8
HV2014004243 ¹	09E0824-335E	26.6	47.5	-20.9	-44.0
HV2014004244 ¹	09E0826-430E	31.0	47.5	-16.5	-34.7
HV2014004245 ¹	28E0920-251E	31.8	47.5	-15.7	-33.1
HV2014004246 ¹	24E0919-653E	30.6	47.5	-16.9	-35.6
HV2014004247 ¹	24E0919-426E	31.7	47.5	-15.8	-33.3
HV2014004248 ¹	09E0824-371E	26.9	47.5	-20.6	-43.4
HV2014004249 ¹	09E0826-428E	30.2	47.5	-17.3	-36.4
HV2014004250 ¹	09E0824-372E	26.7	47.5	-20.8	-43.8
HV2014004251 ^{1,2}	09E1115-430E	38.4	47.5	-9.1	-19.2
HV2014004252 ¹	09E1115-425E	37.4	47.5	-10.1	-21.3
HV2014004253 ¹	09E1115-453E	37.5	47.5	-10.0	-21.1
HV2014004254 ^{1,2}	10E0826-442E	32.2	47.5	-15.3	-32.2
HV2014004255 ^{1,2}	09E0826-433E	32.3	47.5	-15.2	-32.0
HV2014004256 ^{1,2}	24E0919-667E	30.8	47.5	-16.7	-35.2
HV2014004257 ^{1,2}	24E0919-406E	-	47.5	-47.5	-100.0
HV2014004258 ^{1,2}	24E0919-469E	33.3	47.5	-14.2	-29.9
HV2014004259 ^{1,2}	24E0919-647E	31.2	47.5	-16.3	-34.3
HV2014004260 ^{1,2}	09E0824-237E	30.4	47.5	-17.1	-36.0
HV2014004261 ^{1,2}	09E0826-271E	28.5	47.5	-19.0	-40.0
HV2014004262 ^{1,2}	08E1115-313E	41.9	47.5	-5.6	-11.8
HV2014004263 ^{1,2}	08E1115-314E	42.1	47.5	-5.4	-11.4
HV2014004264 ^{1,2}	09E1115-427E	40.1	47.5	-7.4	-15.6
HV2014004265 ^{1,2}	08E1115-305E	41.7	47.5	-5.8	-12.2
HV2014004266 ^{1,2}	09E1115-565E	38.9	47.5	-8.6	-18.1
Supplementary information:					
¹ Electrical module stability analysis not performed					
² Cleaned prior to the measurement					